

THE THIRD LOCALITY FOR CUPRESSUS ABRAMSIANA WOLF

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At the time of publication of *The New World Cupresses* (1948), C. B. Wolf had been unable to locate the area where cypresses were reportedly growing on Butano Ridge in San Mateo County, California. A record of their presence in that region was found in the Dudley Herbarium, the specimens having been first collected by Professor W. R. Dudley, and it was with hesitance that Wolf referred the trees in this third locality to his newly named species, *Cupressus Abramsiana*, which included trees from the Bonny Doon and Eagle Rock areas of Santa Cruz County. Subsequently this reported population has been the object of many searches on the Butano Ridge. Several years ago H. A. Dutton of Los Altos was taken to the cypress locality by James Allen, Deputy Fire Warden of San Mateo County, and it was through their assistance and in their company that the locality was revisited on September 1, 1951. Herbarium material, as well as a large collection of cones, was obtained from Butano Ridge for comparison with material from the other two populations which were revisited on the same date.

The Butano Ridge cypress area is easily reached from the old lumber road along the crest of the ridge. The point of descent from the ridge road is 3.2 miles from the locked gate at the entrance to the Locatelli Mill, north of Big Basin. By travelling about one-half mile on the surfaced road leading into the mill and then turning onto the dirt road along the ridge and following it for 2.7 miles, an old lumber trail is encountered which sharply descends the Butano Creek side of the ridge. A trek of approximately one-quarter mile down the slope leads directly into the cypress area, which probably includes the common corner of sections 11, 12, 13, and 14, of Township 8 South, Range 4 West, Mount Diablo Base and Meridian, Santa Cruz quadrangle.

The stand of cypresses is approximately eight to ten acres in area containing as a rough estimate five thousand trees. Some of the larger cypresses are sixty to seventy-five feet in height with the average being possibly twenty to thirty feet. The entire cypress population is visible from a portion of exposed sandstone in the area and was found to be surrounded on all sides by a taller forest composed principally of *Sequoia sempervirens* (Lamb.) Endl., *Pseudotsuga taxifolia* (Lamb.) Britt., and *Arbutus Menziesii* Pursh. Within the cypress area, no other trees were found, but of the shrubs, *Adenostoma fasciculatum* H. & A. was the most

abundant. *Sphacele calycina* Benth., *Eriodictyon californicum* (H. & A.) Greene and *Arctostaphylos tomentosa* (Pursh) Lindl. were other common shrubs of the cypress area.

The cause for the restriction of the cypress to this locality is possibly in part edaphic. The soil is extremely shallow and in many places the sandstone bedrock was exposed or could be exposed by the removal of a few inches of soil. The sharply sloping hillside precludes any great aggregation of soil which might favor the growth of the taller forest. The common occurrence of sandstone exposures along Butano Ridge, however, reveals little reason for the restriction of cypress to one isolated area.

The three populations included in *C. Abramsiana* by Wolf were formerly treated as *C. Sargentii* after Jepson (1909) separated that taxon from *C. Goveniana* Gord. Wolf considered *C. Abramsiana* to be intermediate between *C. Sargentii* and *C. Goveniana*. He pointed out that it did not have the dusty-green foliage of *C. Sargentii*, but did have the glaucous seeds of that species. A closer relationship seemed to be with *C. Goveniana*, which it resembled in having light green foliage. Wolf admitted that no outstanding characters separated *C. Abramsiana* from the other two species, but decided that if *C. Sargentii* and *C. Goveniana* were to be maintained as distinct, the intermediate should be treated as a coordinate species.

The isolation of the three populations of *C. Abramsiana* from one another is sufficient to preclude any free interchange of genic material, and it is not surprising then to find variation from one population to another. The northern population at Butano Ridge is approximately eight miles north of the Eagle Rock locality, while the Bonny Doon population is seven miles south of Eagle Rock. The possibility of intervening populations or isolated trees along this 15 mile span cannot be dismissed, for owing to the ruggedness of the terrain, the Santa Cruz Mountains are still not completely known floristically.

A striking difference among the populations is to be found in the size of the female cone. Those of the northern population at Butano Ridge are the largest, those at Eagle Rock are intermediate and those at Bonny Doon are the smallest (fig. 1). Variation exists within each population as might be expected. One hundred cones selected from a random collection of each population were measured. The average length of the Butano Ridge population was 28 mm., that of the Eagle Rock population was 24 mm., while that of the Bonny Doon population measured 21 mm. The average cone of each population was slightly elongated. The number of cone-scales of the Butano Ridge population was the most



Bonny Doon Eagle Rock Butano Ridge

FIG. 1. A random selection of cones from the three populations of *Cupressus Abramsiana* Wolf.

variable, but cones composed of 10 and 12 scales were common, the average being represented by the figure 10.4. The Bonny Doon and Eagle Rock populations were predominantly of 8-scaled cones, although the average number for the hundred cones was found to be 8.5 and 8.7 respectively. None of the populations regularly produces cones as small as those of *C. Goveniana*, which are from 10 to 15 mm. long and nearly globose. The mature cones of the many disjunct populations of *C. Sargentii*, however, are extremely variable, the extremes in length measuring 15 and 30 mm. The Bootjack, Mount Tamalpais population of *C. Sargentii* in Marin County is characterized by rather large cones, but none exceeds 30 mm. in length and the majority measure between 20 and 30 mm. The number of cone-scales is usually from 6 to 8 in both *C. Goveniana* and *C. Sargentii*.

The type specimen of *C. Abramsiana* from Bonny Doon is reported by Wolf to have very glaucous seeds. Approximately half of the cones from Bonny Doon yielded glaucous seeds, but at the Eagle Rock and Butano Ridge areas very few produce even slightly glaucous seeds. The seeds of all

three populations vary from light to dark brown. Seed-size seems to be correlated with the size of the cones, the smallest, of which the average length was 4 mm., being from the Bonny Doon area and the largest, being from Butano Ridge with the average measuring 4.5 mm. In contrast, seeds produced by *C. Goveniana* are non-glaucous, dark brown to dull black, and mostly 3 mm. in length, while *C. Sargentii* regularly produces glaucous seeds which are dark brown and vary in length from 4 to 5 mm.

As has been indicated, the foliage of *C. Sargentii* is a dusty-green, while that of *C. Goveniana* is a light green. In regard to color, the foliage of the three populations of *C. Abramsiana* is more similar to that of *C. Goveniana*. While the Bonny Doon area has many smaller trees, of a yellow green color, growing on sandstone exposures, many of the larger trees have dark green foliage. In contrast to the rather coarse foliage of the cypresses in the Bonny Doon area, those of Butano Ridge have foliage which is characteristically much finer. In its type of foliage, the Eagle Rock population more closely resembles that of Butano Ridge.

In addition to morphological differences, a distinct difference of habitat characterizes *C. Sargentii*, *C. Abramsiana* and *C. Goveniana*. *Cupressus Sargentii* is known only from serpentine areas distributed in the coast ranges from northern Mendocino County to Santa Barbara County. In its widely disjunct pattern of distribution, it resembles many other serpentine-restricted species. In contrast, *C. Goveniana* is known from only two small disjunct populations in Monterey County, where it occurs on a sandy podsolic soil on Huckleberry Hill and on a sandy outcropping near San Jose Creek behind Point Lobos. [As treated by Abrams (1923), and by McMinn (1935, 1939), *C. Goveniana* includes, in addition to the Monterey populations, those Mendocino County populations which are considered here to be *C. pygmaea* (Lemm.) Sarg.] *Cupressus Abramsiana* is restricted to soils which are principally derived from sandstone. In a discussion of the distributional patterns of members of the genus *Cupressus*, Mason (1946) noted a suggestion of a relationship with edaphic conditions. He was led to conclude that speciation in the genus has been rather closely related to edaphic patterns of environmental restriction. The Bonny Doon population of *C. Abramsiana* is found to be growing with *Pinus attenuata* Lemm. and two narrowly-restricted species of *Arctostaphylos*, *A. sensitiva* Jepson, which is confined to dry mountain slopes of the Santa Cruz Mountains and of southern Marin County, and *A. silvicola* Jeps. and Wies., which is confined to sand deposits in the Mount Hermon region of the Santa Cruz Mountains. Some of the largest cypresses at Bonny Doon occur in the deeper sandy

soils with *Pinus ponderosa* Dougl. At Eagle Rock, some *Pinus attenuata* is growing on the crest of the ridge, but over most of the cypress area, it is absent. A dense brush cover composed of *Adenostoma fasciculatum* H. & A., *Ceanothus cuneatus* (Hook.) Nutt., *Photinia arbutifolia* Lindl. and *Pickeringia montana* Nutt. is the main associated vegetation. As has been indicated, the Butano Ridge cypresses are found principally with *Adenostoma fasciculatum*, and although *Pinus attenuata* is frequent along Butano Ridge, none was found growing within the cypress area. The distributional patterns might suggest that the cypress and pine are growing together at Bonny Doon because they each have different requirements of the environment and that only the cypress requirements are fulfilled at Butano Ridge. On the other hand, a suggestion that a different physiological tolerance characterizes each population of cypress seems worthy of consideration. From studies in progress, it would seem that the premise of different requirements by pines and by cypresses at Bonny Doon is well substantiated. And it seems not at all unlikely that physiological differences characterize the three populations of cypress as much as morphological ones. *Pinus attenuata* is one of the Californian plants which would be considered "bodenwag" in that it is not restricted to one soil type but is found on serpentine as well as other soils, and its presence therefore with *C. Sargentii* in some areas of Napa and Lake counties is not unexpected. However, whether *P. attenuata* be differentiated into races tolerant and intolerant of serpentine soils, as has been recently demonstrated by Kruckeberg (1951) for certain herbaceous *bodenwag* species which occur on serpentine soils, is yet to be ascertained. At any rate, *C. Sargentii* is found with *P. attenuata* but is more commonly to be found in areas with *P. Sabiniana* Dougl. As might be expected of a species widely disjunct in its distribution, *C. Sargentii* is found growing with different plants in northern Mendocino County from those in Santa Barbara County, but is found commonly with the shrubby species which characterize the Eagle Rock and Butano Ridge areas of *C. Abramsiana*. *Cupressus Goveniana* occurs in areas of greater rainfall than does *C. Sargentii* and *C. Abramsiana*, and is found on Huckleberry Hill, with one of the disjunct populations of *Pinus muricata*. Here also, a few large cypresses grow with *Pinus radiata* Don, but the greatest concentration of cypresses are dwarfed and confined to a limited area with a low growth of *P. muricata*, *Arctostaphylos Hookeri* Don, and *Arctostaphylos tomentosa* (Pursh) Lindl. The species composition of both the Huckleberry Hill and San Jose Creek cypress stands bears little similarity to that found in the *C. Abramsiana* and *C. Sargentii* areas.

In an attempt to explain the characteristics of *C. Abramsiana* which are, in some respects, intermediate between *C. Sargentii* and *C. Goveniana*, an origin resulting from hybridization of those two species might be hypothesized. The Santa Cruz Mountains, where *C. Abramsiana* is restricted, lie equidistant from *C. Goveniana* localities of Monterey County to the south, from the *C. Sargentii* locality of Mount Tamalpais, Marin County, to the north, and from the *C. Sargentii* locality of Cedar Mountain, Alameda County, to the east. The distance in each instance is approximately 50 miles, a separation which removes a reasonable possibility of gene exchange at the present time. However, the fossil record indicates that *Cupressus* has grown in many places along the coast of California where it is now absent from the existing flora. Pleistocene fragments and cones which are similar to present *C. Goveniana* have been referred to that species by Chaney and Mason (1930), largely by reason of their being found with cones of *P. muricata*, a species with which *C. Goveniana* occurs today. The existence of colonies of *C. Goveniana* and *C. Sargentii* in mutual proximity during the Pleistocene would have facilitated hybridization, while subsequent isolation with biotype depletion (Stebbins, 1942) acting to confine the species, would have allowed for sufficient divergence of *C. Abramsiana* from either species. As it is understood at the present time, *C. Abramsiana* may be regarded as a discrete but highly variable entity. Its relationship is certainly not so close to *C. Goveniana* as is that of *C. pygmaea* and yet there are decided morphological and ecological differences which oblige the separation of *C. Abramsiana* from *C. Sargentii*.

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